

Technical description of the Atari interface (V 1.8E)

First, there is a short overview of technical terms and certain technical concepts. The operation of the Atari interface is explained after that. If you are familiar with ASCII code, the Centronics interface, auto line-feed, representations of numbers in binary and hexadecimal systems and related expressions, you may skip the following sections.

Furthermore, this presentation can only provide an overview, and cannot replace a foundation in computers and printers.

Basics of ASCII Code and Number Systems

In microcomputer technology, as well as in other areas of computer technology and communication, the 'AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE' (abbreviated 'ASCII') is often used. It assigns a seven-bit binary word to each letter of the alphabet as well as some punctuation and control characters. This binary word is a combination of '1' and '0' (e.g. 1000101 is associated with the letter 'E').

Since microcomputer technology uses eight-bit-wide words, a zero is placed at the highest position of the word, so the value remains unchanged. Such a word is also called a 'byte'.

The ASCII standard is originally American, so it does not contain accented characters (umlauts) used in German. In order to make it usable for texts with umlauts, special characters not used in Germany are repurposed to provide umlauts.

A complete ASCII table can be found below.

However, the bit-by-bit representation just described is too cumbersome for regular use, so there are other representation options. The decimal and hexadecimal representations are common.

As with almost all systems for representing numbers, the lowest value of the number is on the far right; higher-value digit is one place further to the left. The value of a digit depends on its position in the number and on the number base to which this number belongs. In the binary number system, each digit can express two values. The value of a digit in the binary system is thus obtained by multiplying the next lower digit by a factor of two. The rightmost (least valued) digit always has the value of one in any number system.

The values of successive digits in the decimal system we are familiar with are related by a factor of 10. In the hexadecimal system they are related by a factor of 16.

Because 16 symbols are needed to represent a digit in the hexadecimal system, the letters A to F are also used, which together with the already known ten symbols 0 to 9 allow us to represent the required number (A = 10, B = 11, C = 12, D = 13, E = 14, F = 15).

The following examples are intended to clarify these relationships:

Binary system	Value at position: ...128,64,32,16,8,4,2,1

10010110	means $1 \cdot 128 + 0 \cdot 64 + 0 \cdot 32 + 1 \cdot 16 + 0 \cdot 8 + 1 \cdot 4 + 1 \cdot 2$
+ 1*0	
	= 150

Decimal system	Value at position: ...1000,100,10,1

4530	means $4 \cdot 1000 + 5 \cdot 100 + 3 \cdot 10 + 0 \cdot 1$
	= 4530

Hexadecimal system	Value at position: ...65536,4096,256,16,1

9E31	means $9 \cdot 4096 + 14 \cdot 256 + 3 \cdot 16 + 1 \cdot 1$
	=40497

To distinguish which number system is meant when a number is specified, a letter is placed after the number.

B=binary, D=decimal, H=hexadecimal

Examples:

1001B means 9D (9 decimal)
1BH means 27D (27 decimal)

Centronics Interface

This interface is used to transfer data from the computer to the printer. It was first implemented by the company Centronics and has since become a quasi-standard that has been adopted by many other printer manufacturers.

A technical description of this interface is outlined below.

Normally, the printer only executes the commands it receives. Exceptions are the 'Carriage Return' (CR) and 'Line Feed' (LF) commands. Many printers can be switched to the 'auto line-feed' operating mode. On receiving the command 'CR', they will also execute a line feed.

The present Atari interface can only be operated with printers in 'auto line-feed' setting.

Basics of the Atari interface

This interface is used to operate a printer with Centronics input using an Atari computer 600XL or 800XL.

The connected printer can only be operated in auto-linefeed mode.

The interface also works in conjunction with the word processor 'AtariWriter'. However, there are then some subtleties to consider, which are described below.

The interface should only be put into operation when the user has basic clarity about all components when using the interface.

The electronics of the interface are housed in the small blue box. It has a molded Centronics plug on one side for plugging into the corresponding Centronics socket of the printer.

On the other side of the interface there is a cable with an Atari plug for the 'Peripheral' socket on the back of the computer. If this socket is already occupied by a floppy drive, the free 'Peripheral' socket at the back of the drive can be used.

Inside the interface is a small 6-way slide switch (DIP switch). The position of the switch marked '1' effects the function of the interface as described further below.

Switches '2' to '6' must be set to 'OFF'; although they have no significance for the function of the interface, they cause short circuits between certain lines when they are closed.

To operate the DIP switch, the housing of the interface must be carefully opened. It consists of two halves; the halves are fixed to each other by four plastic brackets. If you lift these brackets one after the other via the locking lugs, the halves of the housing detach from each other. However, great caution is required, as these brackets break off if they bend too much.

The position of DIP switch 1 determines whether the interface uses an internal code

conversion table. However, this DIP switch is only read when the interface is switched on at which time its value is copied into an internal software switch. Changing the DIP switch while the interface is live has no effect. However, the internal software switch can be toggled from the computer by means of appropriate commands.

To start up the interface, ensure all devices are switched off. Connect the printer to the interface and the interface to the computer or floppy drive. The interface is powered by the Atari, so it doesn't need an additional power supply. During the power-on procedure, the printer is switched on as the last device.

Once all devices are turned on, the computer can address the printer. However, attention must be paid to the position of the DIP switch; the details are explained below.

If DIP switch 1 is set to OFF when switched on, all bytes sent from the computer to the interface will reach the printer unchanged. Only the byte 9BH used by Atari to mark the end of the line is converted into a CR (13D) by the interface.

If DIP switch 1 is set to ON when switched on, a few bytes will be converted according to the summary below.

It is also possible to switch between the two operating modes by means of two specific commands initiated by the ESC character. Here is a summary of the operating modes of the interface:

ESC-Code		Effect
ASCII:	Decimal:	
ESC NUL	27D,0	As described under "S1 ON"
ESC SOH	27D,1	As described under "S1 OFF"

The ESC codes sent for switching do not reach the printer.

S1 OFF

The interface passes on all Atari codes unchanged. Only the end of line symbol 9BH is converted to CR (0DH).

EPSON FX80 and compatible printers need to be operated in this switch position only on the Atari 600/800, and on any Atari running the 'AtariWriter' program. When using this program, select EPSON FX-80 (No. 4) from the printer menu.

S1 ON

The interface converts certain codes according to the following table. This switch setting is used to operate any printer with a Centronics interface on an Atari with the

Writer program. In the menu for printer selection, select ATARI 1027 (No. 3). Atari then sends the code for 's' (115D) twice in a row instead of the 'ß'!

AtariWriter Code		Code from IF		Meaning
0AH	10D	7DH	125D	ü
0BH	11D	7BH	123D	ä
0CH	12D	5CH	92D	Ö
0FH	15D	7CH	124D	ö
10H	16D	5DH	93D	Ü
7BH	123D	5BH	91D	Ä
9BH	155D	0DH	13D	CR

The code conversion was implemented because the word processing program 'AtariWriter' uses certain bytes of its own for the umlauts, which do not correspond to the German ASCII character set and are therefore misinterpreted by the vast majority of printers.

The 'AtariWriter' program uses these other codes for the umlauts when selecting options 1 to 3 in the printer selection menu.

If No. 4 (EPSON) is selected, the umlauts are sent according to the ASCII table (see below), but there are also a number of other commands (ESC sequences) that are only understandable for EPSON FX-80 printers and usually cause chaos during printing on all other printers.

The 'AtariWriter' program also sends ESC sequences for selections 1 to 3, but these are suppressed by the interface as long as it is in 'Code Conversion' mode and printer no. 3 (ATARI 1027) is selected.

If you are working with the 'AtariWriter' program and want to send certain codes in the middle of the text to control the printer, but those commands are subject to conversion, you must first switch off the code conversion of the interface using the software command described above.

The 'AtariWriter' program sends all numbers in the range from 0 to 127 unchanged (i.e. binary, not as an ASCII value) to the printer if they are preceded by a 'Control-O' in the text.

'Control-O' means pressing the Control and O buttons at the same time.

If, for example, the code conversion of the interface is to be switched off from the 'AtariWriter' program, this requires the inputs

Ctrl-O 27 Ctrl-O 1

Each number to be sent must be preceded by Ctrl-O; several inputs of this kind in a row must not be separated by a comma, as the writer interprets this as a character for the expression.

The inputs after Ctrl-O must be decimal.

The reactivation of the code conversion is thus done by

Ctrl-O 27 Ctrl-O 0

End of description (Tables are on the next page) DI 9-4-1985

US-ASCII Code Table

		0	0	0	0	1	1	1	1
		0	0	1	1	0	0	1	1
		0	1	0	1	0	1	0	1
		0	1	2	3	4	5	6	7
0000	0	NUL	DLE	SP	0	@	P	`	p
0001	1	SOH	DC1	!	1	A	Q	a	q
0010	2	STX	DC2	"	2	B	R	b	r
0011	3	ETX	DC3	#	3	C	S	c	s
0100	4	EOT	DC4	\$	4	D	T	d	t
0101	5	ENQ	NAK	%	5	E	U	e	u
0110	6	ACK	SYN	&	6	F	V	f	v
0111	7	BEL	ETB	'	7	G	W	g	w
1000	8	BS	CAN	(	8	H	X	h	x
1001	9	HT	EM	)	9	I	Y	i	y
1010	A	LF	SUB	*.	:	J	Z	j	z
1011	B	VT	ESC	+	;	K	[	k	{
1100	C	FF	FS	,	<	L	\	l	
1101	D	CR	GS	-	=	M	]	m	}
1110	E	SO	RS	.	>	N	^	n	~
1111	F	SI	US	/	?	O	_	o	DEL

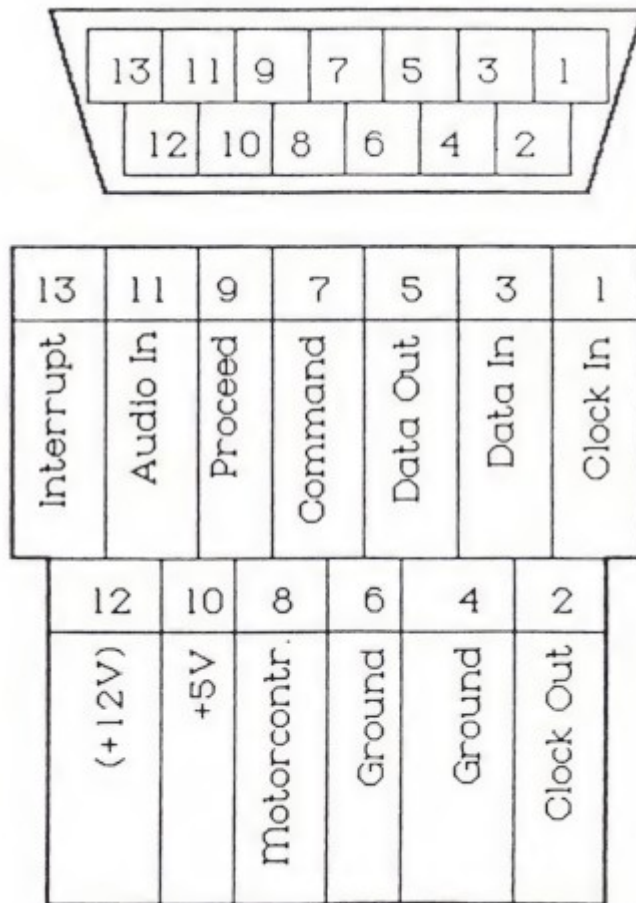
German-ASCII Code Table

		0	0	0	0	1	1	1	1
		0	0	1	1	0	0	1	1
		0	1	0	1	0	1	0	1
		0	1	2	3	4	5	6	7
0000	0	NUL	DLE	SP	0	S	P	`	p
0001	1	SOH	DC1	!	1	A	Q	a	q
0010	2	STX	DC2	"	2	B	R	b	r
0011	3	ETX	DC3	#	3	C	S	c	s
0100	4	EOT	DC4	\$	4	D	T	d	t
0101	5	ENQ	NAK	%	5	E	U	e	u
0110	6	ACK	SYN	&	6	F	V	f	v
0111	7	BEL	ETB	'	7	G	W	g	w
1000	8	BS	CAN	(	8	H	X	h	x
1001	9	HT	EM	)	9	I	Y	i	y
1010	A	LF	SUB	*	:	J	Z	j	z
1011	B	VT	ESC	+	;	K	Ä	k	ä
1100	C	FF	FS	,	<	L	Ö	l	ö
1101	D	CR	GS	-	=	M	Ü	m	ü
1110	E	SO	RS	.	>	N	^	n	ß
1111	F	SI	US	/	?	O	_	o	DEL

Example: "A" = 0100 0001 binary = 41 hex = 65 decimal

View of the Atari computer from behind

Interface description Atari 600/800 etc.



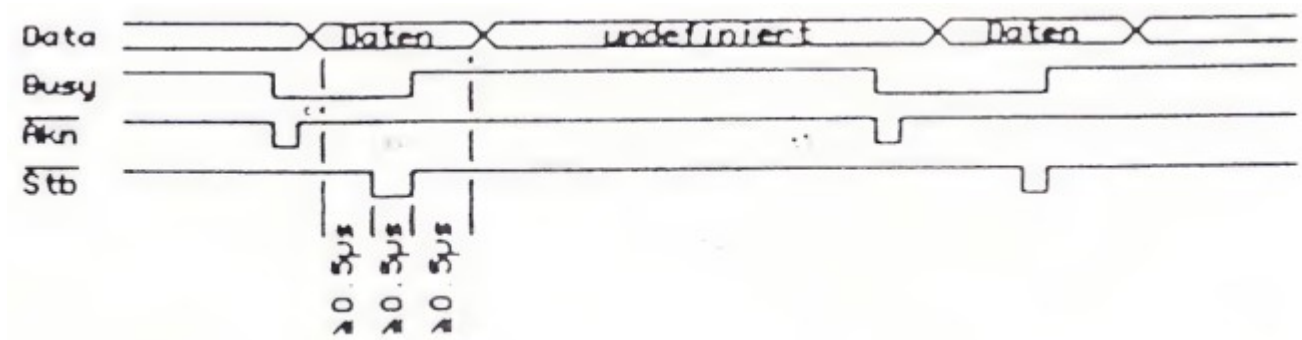
The Atari home computers use a special serial port at the TTL level. This interface requires a special protocol and is not compatible with any other serial port. For this reason, RS232 peripherals, for example, can only be connected with the help of an interface.

Centronics interface description

Pin	Signal	Source	Pin	Signal	Source
1	Strobe	Computer	19	Ground	
2	Data 0	Computer	20	Ground	
3	Data 1	Computer	21	Ground	
4	Data 2	Computer	22	Ground	
5	Data 3	Computer	23	Ground	
6	Data 4	Computer	24	Ground	
7	Data 5	Computer	25	Ground	
8	Data 6	Computer	26	Ground	
9	Data 7	Computer	27	Ground	
10	Ack	Printer	28	Ground	
11	Busy	Printer	29	Ground	
12	Paper empty	Printer	30	Ground	
13	Select	Printer	31	Init	Computer
14	see below	Computer	32	Error	Printer
15	not used		33	not used	
16	Ground		34	not used	
17	Chassis		35	not used	
18	+5V	Printer	36	not used	

If pin 14 of some printers is set to ground, the "auto line-feed" mode is switched on (after CR, LF is also executed).

Data transfer timings



Clarifications:

The computer then sends data to the printer when the printer signals:

- Paper-Empty = Low: paper is loaded
- Select = High: printer is ON-LINE
- Error = High: there is no misoperation
- Busy = Low: The printer can accept data

The first three conditions are "static" — they only change when paper runs out, the printer is set to "offline", or an error occurs (head blocked, etc.). The Busy signal, on the other hand, indicates that the printer is busy processing a character — it is therefore set high every time a character is received. The Busy signal is also logically linked to the other three in the printer — if one of the three conditions mentioned above occurs, this is precisely specified by setting the respective line and in addition, the printer indicates by busy-high that it cannot accept data. When the printer is ready to receive, each byte is transmitted using the strobe signal: the computer sends the byte and generates a strobe pulse of at least $0.5 \mu\text{s}$ for each byte.

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ADD-ON TO THE NEW VERSION ATARI-INTERFACE 72000

The previous description of the Atari interface (Ver 1.8E) is still valid, but the function described below is also possible.

The DIP switches 2,4,5,6 in the interface still have no function. They must be in the 'OFF' position.

The function of switch 3 is new:

S3 OFF

The interface behaves as described in the previous pages.

S3 ON

The code conversion of the interface is forcibly switched off. It is not possible to reactivate the code conversion via software. Only switching back from S3 to OFF restores the previous function of the interface.

In this switch position, all bytes from the Atari computer reach the printer unchanged; the only exception is the end of line symbol. (9BH -> 0DH)

The S3 switch is constantly monitored, so it is possible to press this switch as often as you like during the operation of the interface.

This functional extension was necessary because it is possible for graphic printouts to use precisely those byte sequences that are intended to change the operating mode of the interface.

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